Journal of Advanced Research in Dynamical and Control Systems, 2018, vol.10, N10 Special Issue, pages 1723-1728

Neural network method of dynamic biometrics for detecting the substitution of computer

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018, Institute of Advanced Scientific Research, Inc.. All rights reserved. In this paper, we research the dynamic neural network method for biometric identification of computer users. We analyze the task of detecting the substitution of computer systems users basing the methods of password authentication or authentication using technical devices. To solve this problem, the need to apply biometric authentication methods is actualized. Various methods of users biometric features isolating based on discrete orthogonal transformations are considered. The requirements for choosing biometric identification and authentication methods are formulated: there is no need for additional hardware equipment, the possibility of imperceptible user identification and the analyzed features readability during the workstation use. According on these requirements necessity of users' recognition based on the mouse moves dynamics is justified. The technique of initial data collecting and their preparation for analysis on the basis of neural network training is described. The neural network model construction use "Deductor" environment. The method of informative features optimal system and neural network architecture searching is developed. We suggested the most efficiency neural network model by the obtained analysis results for computer user's biometric identification. As the criterion of neural network model optimality the minimal error in user substitution detecting was chosen. The best was a neural network with 6 neurons in the hidden layer, a binary output and 10 input neurons.

Keywords

Biometrics, Choice of a system of informative features, Correlation analysis, Identification and authentication, Neural network, Protection of an automated workplace

References

[1] Zhao, D., Luo, W. One-time password authentication scheme based on the negative database // Engineering Applications of Artificial Intelligence. – 2017. – N 62. – pp. 396-404.

[2] Madhusudhan, R., Hegde, M. Security bound enhancement of remote user authentication using smart card // Journal of Information Security and Applications. – 2017. – N 36. – pp. 59-68.

[3] Scheidat, T., Kalbitz, M., Vielhauer, C. Biometric authentication based on 2D/3D sensing of forensic handwriting traces // IET Biometrics. – 2017. – N 6(4). – pp. 316-324.

[4] Fernández-Martínez, J. L., A. Cernea. "Numerical Analysis and Comparison of Spectral Decomposition Methods in Biometric Applications." International Journal of Pattern Recognition and Artificial Intelligence, vol. 28, no. 1, 2014, www.scopus.com, doi:10.1142/S0218001414560011

[5] Thepade, S. D., R. K. Bhondave. Bimodal Biometric Identification with Palmprint and Iris Traits using Fractional Coefficients of Walsh, Haar and Kekre Transforms, 2015, www.scopus.com, doi:10.1109/ICCICT.2015.7045729.

[6] Choudhary, A., and R. Vig. Face Recognition using Multiresolution Wavelet Combining Discrete Cosine Transform and Walsh Transform, vol. Part F128052, 2017, www.scopus.com, doi:10.1145/3077829.3077835.

[7] Kekre, H. B., T. Sarode, and S. Natu. Biometric Watermarking using Partial DCT-Walsh Wavelet and SVD, 2016, www.scopus.com, doi:10.1109/ICIIP.2015.7414752.

[8] Juefei-Xu, F., et al. Investigating Age Invariant Face Recognition Based on Periocular Biometrics, 2011, www.scopus.com, doi:10.1109/IJCB.2011.6117600.

[9] Vasagiri, K., and S. R. Parvata. Dorsal Hand Vein Biometric Authentication using Complex Walsh Transform, 2017, www.scopus.com, doi:10.1109/ICATCCT.2016.7912057.

[10] Ismagilov, I. I. Discrete transforms in basis of piecewise-power functions and their properties," Izv. Vyssh. Uchebn. Zaved., Radioelektron. 44(3), 54 (2001); Radioelectron. Commun. Syst. 44(3), 46 (2001).

[11] Ismagilov, I. I. Discrete Transforms in Basis of Walsh-Like Functions: Theory and Application in Digital Signal Processing (Otechestvo, Kazan, 2003) [in Russian].

[12] Ismagilov, I. I. Inclined Rademacher functions: properties and application in digital signal processing problems, Izv. Vyssh. Uchebn. Zaved., Radioelektron. 39(12), 11 (1996); Radioelectron. Commun. Syst. 39(12), 9 (1996).

[13] Ismagilov, I.I. A class of discrete orthogonal bases for representing and processing digital signals Automatic Control and Computer Sciences, 30 (3), pp. 62-66.

[14] Ismagilov, I.I. An approach to ordering of systems of the Walsh discrete functions Radioelectronics and Communications Systems, 49 (1), pp. 46-50.

[15] Ismagilov, I.I. Oblique generalizations of the Walsh basis Radioelectronics and Communications Systems, 53 (12), pp. 625-635. doi: 10.3103/S0735272710120010

[16] Ismagilov, I. I. et al. General method of synthesis by PLIC/FPGA digital devices to perform discrete orthogonal transformations. Journal of Fundamental and Applied Sciences, [S.l.], v. 9, n. 2S, p. 998-1007, aug. 2017. ISSN 1112-9867.

[17] Katasev, A.S., Kataseva, D.V. Expert diagnostic system of water pipes gusts in reservoir pressure maintenance processes // 2016 2nd International Conference on Industrial Engineering, Applications and Manufacturing, ICIEAM 2016-Proceedings 7911651.

[18] Katasev, A.S., Kataseva, D.V. Neural network diagnosis of anomalous network activity in telecommunication systems // 2016 Dynamics of Systems, Mechanisms and Machines, Dynamics 2016, 7819020.

[19] Katasev, A.S., Kataseva, D.V., Emaletdinova, L.Yu. Neuro-fuzzy model of complex objects approximation with discrete output // 2016 2nd International Conference on Industrial Engineering, Applications and Manufacturing, ICIEAM 2016-Proceedings 7911653.

[20] Kataev, A.S, Kataev, D.V., Kirpichnikov, A.I., Kostyuzhov, S.G. Neural network model of user recognition in distance learning systems // Bulletin of the Technological University.-2015.-T. 18.-No. 13.-P. 160-163.

[21] Karpuzova, V.I., Skripchenko, E.N., Stratonovich, Yu.R., Chernysheva K.V. Information technology in economics. Decision Support Systems on the basis of AP Deductor Studio Academic 5.1: a textbook for students of the Faculty of Economics.-Moscow: Izd. FGOU HPE RGAU-MAHA, 2010.-80 s.

[22] Zagoruiko, N.G. Applied methods of data and knowledge analysis.-Novo-Sibirsk: Publishing house of the Institute of Mathematics, 1999.-270 p.

[23] Mateo F., Carrasco J.J., Sellami A., Millán-Giraldo M., Domínguez M., Soria-Olivas E. Machine learning methods to forecast temperature in buildings // Expert Systems with Applications, 2013. Vol. 40, no. 4.

[24] Emaletdinova, L.Y., Matveev, I.V., Kabirova, A.N. Method of constructing a neural regulator for the automatic one-dimensional control of a technical object // Russian Aeronautics, 2015, 58 (2), pp. 227-232.

[25] Emaletdinova, L.Y., Tsaregorodtseva, E.D. Algorithms of constructing a neural network model for a dynamic object of control and adjustment of PID controller parameters // Russian Aeronautics, 2013, 56 (3), pp. 247-256.